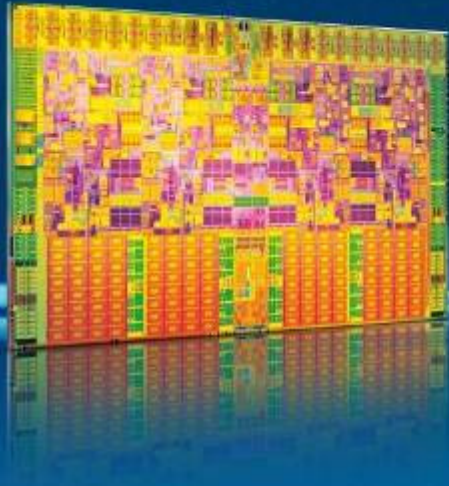




# The Cloud Architecture Transformation



**Jim Blakley**

Director, DC Virtualization and Cloud Computing  
Intel Architecture Group

*5th Annual IT Security Automation Conference,  
Baltimore, MD - Oct. 26-28, 2009*

# What's Different About Cloud?

## User Expectations

- 1 Elasticity
- 2 Self Service
- 3 Pay-as-you-go
- 4 Secure and Reliable

## Data Center Requirement

Massive Scale  
Multi-tenancy  
Low TCO



Deployments require "Built for Scale and Automation"

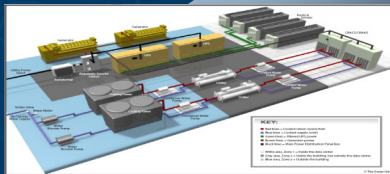
# How do They Do It?

**Microsoft\***

**Google\***

**amazon\***  
web services™

Data Center

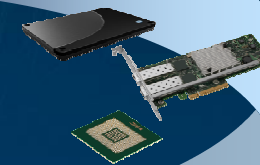


Software



Technologies & Management

Server, Storage, Switches



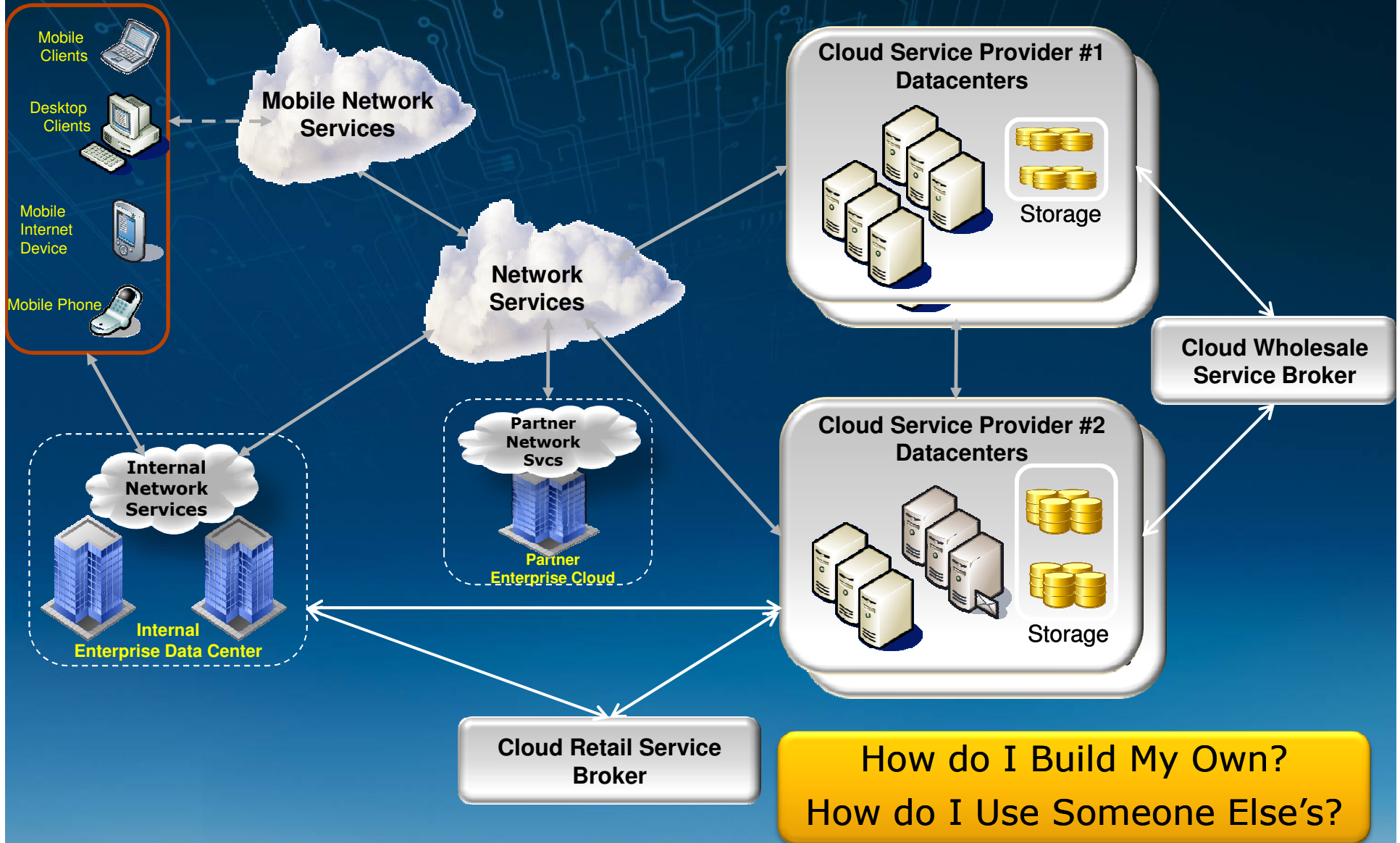
Tight coupling across software, hardware, data center

Resource	Cost in Medium DC	Cost in Very Large DC	Ratio
Network	\$95 / Mbps / month	\$13 / Mbps / month	7.1x
Storage	\$2.20 / GB / month	\$0.40 / GB / month	5.7x
Administration	≈140 servers/admin	>1000 servers/admin	7.1x

Source: Hamilton 2009.03.28: Cloud Computing Economies of Scale, Keynote, [Self-Managing Database Systems](#), Shanghai.

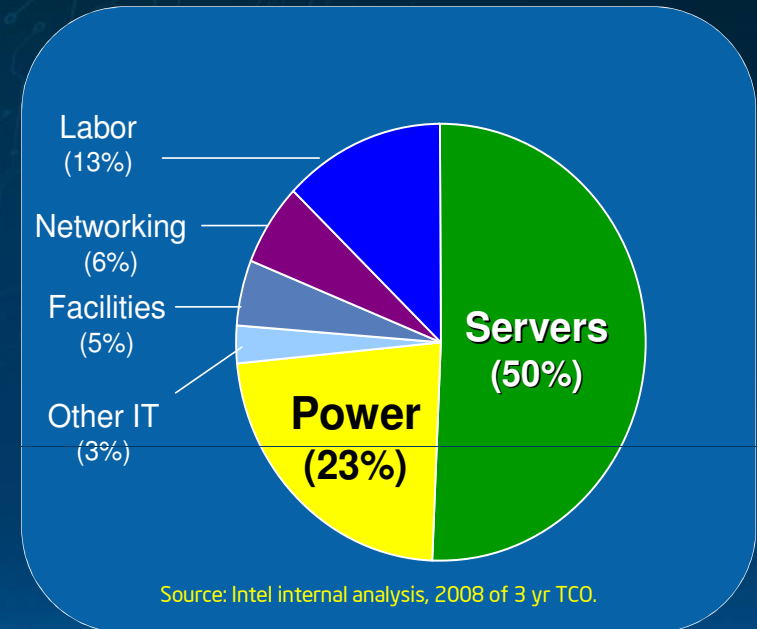


# Enterprise Virtual Private Cloud Reference Model



# Architecture Issues in Building and Using Clouds

- What are good applications for the Cloud?
- How do I get maximum value from my infrastructure?
- Can I really trust it?
- How can I tell what's going on with my cloud application?
- Where are the performance bottlenecks? How can I eliminate them?



# Enterprise Web 2.0 Apps in The Cloud



Technical Support  
1.866.915.3383  
216.444.1740  
mychartsupport@ccf.org

March 20, 2009

Welcome to...

e | Cleveland Clinic  
**MyChart**<sup>®</sup>  
Your personal health connection™



MyChart ID  
  
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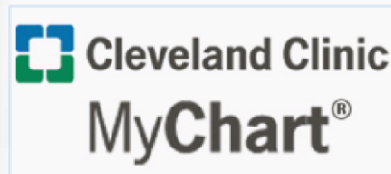
MyChart © Epic Systems Corporation

### Important MyChart information

MyChart will be unavailable Saturday March 21, 2009, from 12:00am to 12:30am, and Sunday March 22, 2009, from 6:00am to 6:00am. We apologize for the inconvenience.



Personal health services [« Back to Import medical records](#)



## Cleveland Clinic MyChart

Cleveland Clinic MyChart, is a secure, Internet-based service connecting patients to portions of their electronic medical record anytime, anywhere. Renew prescriptions, request appointments, view medications and test results and receive important health reminders to help you plan your ongoing health care. If you have received medical care from Cleveland Clinic, or plan to go there for medical care, you can securely import your medical records from MyChart into your Google Health Profile. MyChart® licensed from Epic Systems Corporation, © 1999-2008. Patents pending.

[Cleveland Clinic MyChart privacy policy](#)

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Sometimes, its not about meeting the legacy requirements

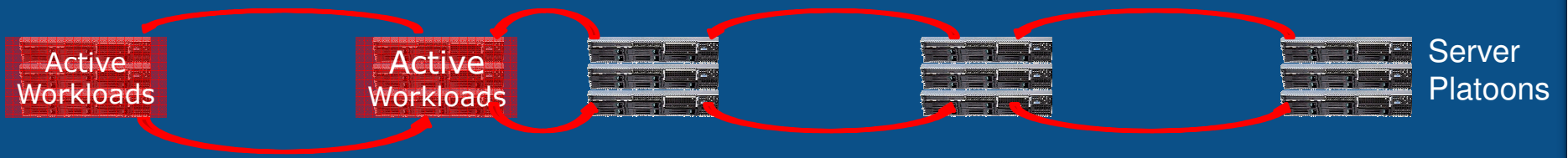
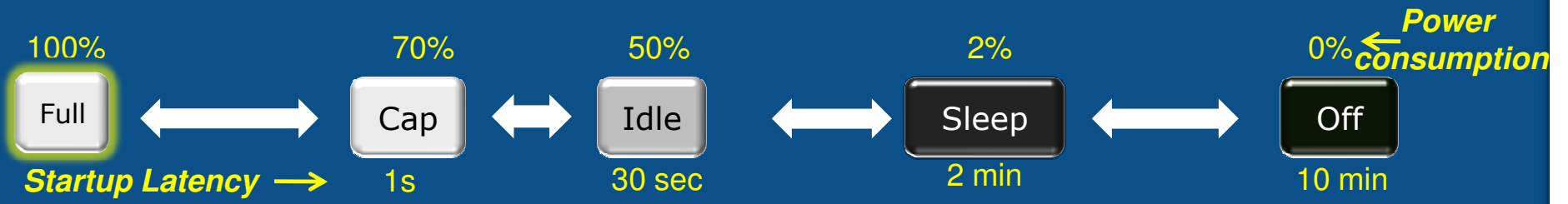
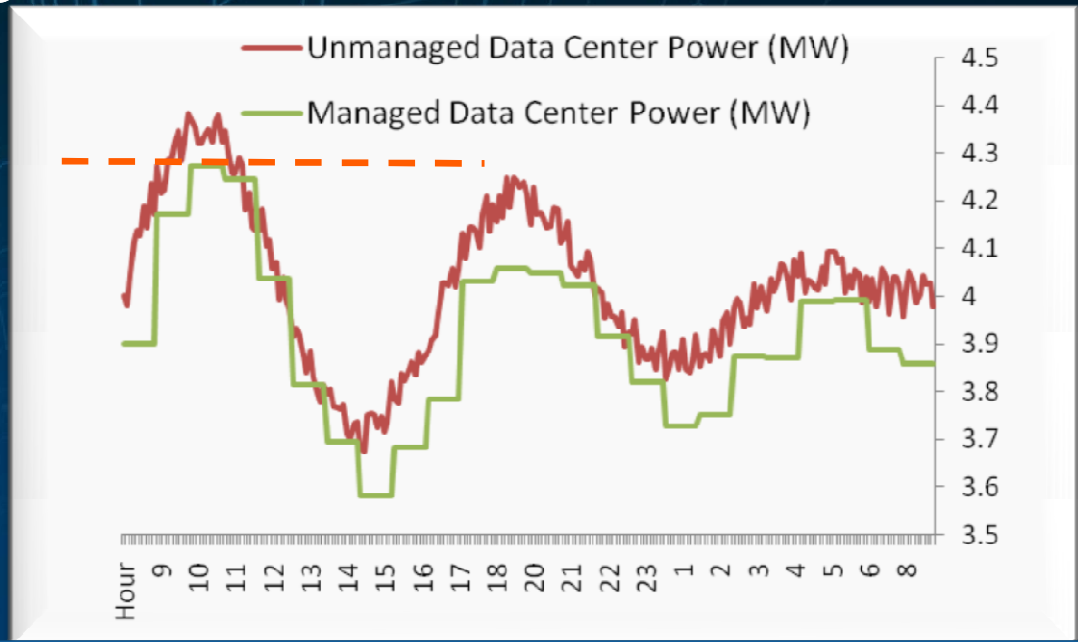
...

Even for the Enterprise

# Active Power Management in the Data Center

Business Need:

- Reduce Overall Consumption
- Cap Busy Hour Peak

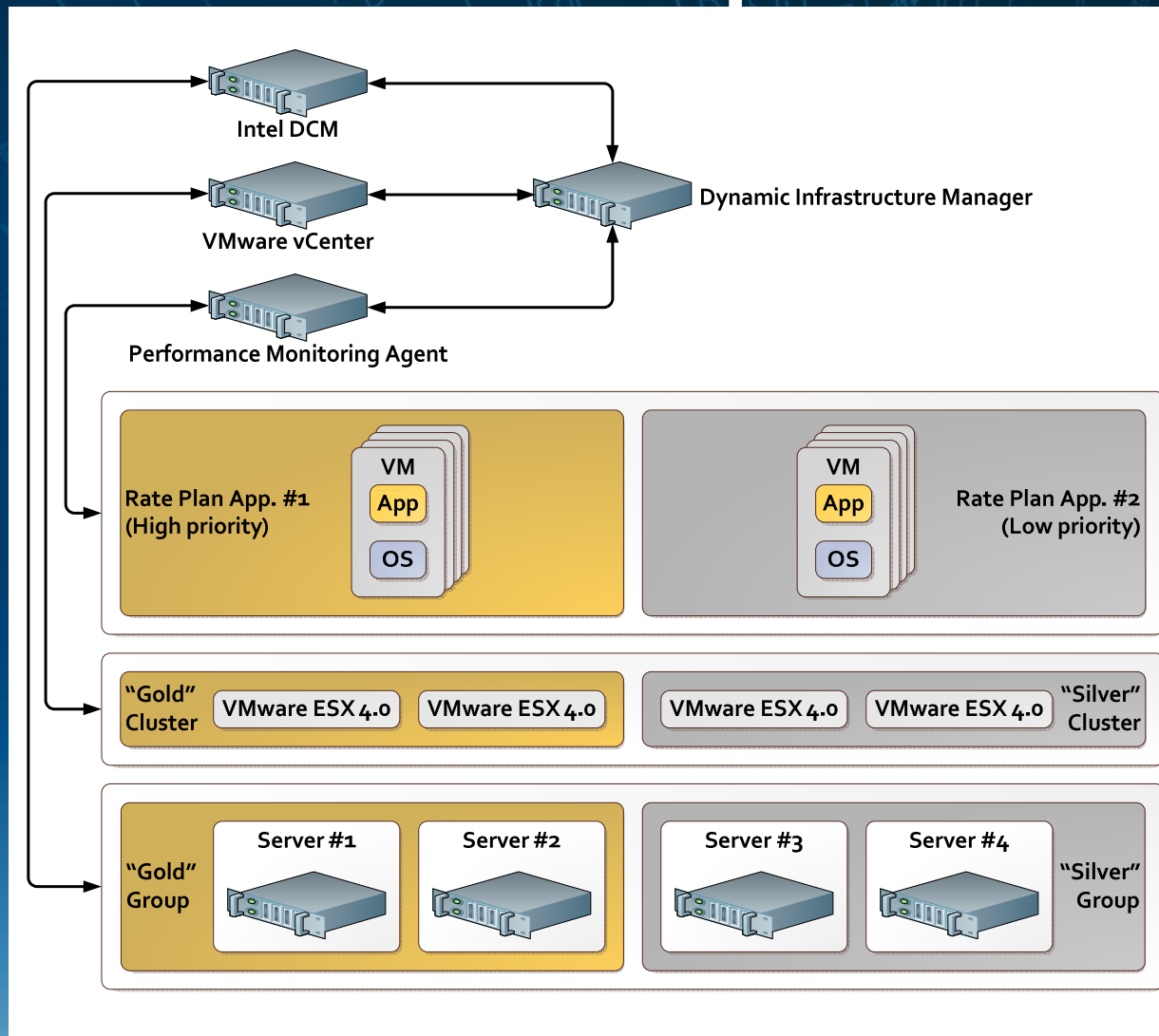


Sophisticated Workload Placement can lead to much higher efficiency

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# Telefónica\* Green Data Center Experiment



## Three management levels:

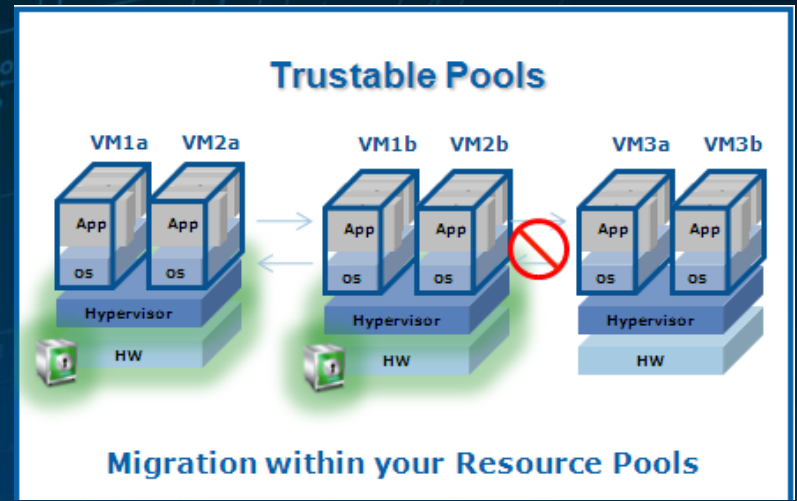
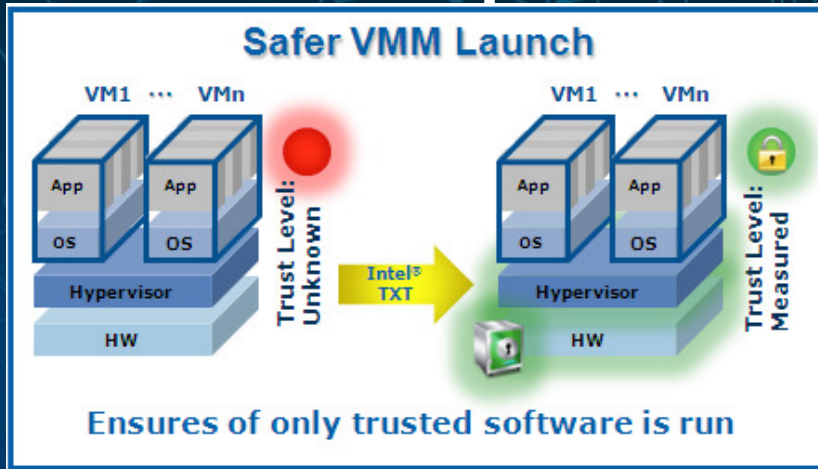
- Server Hardware (DCM)
  - Group power capping with priority directive
  - Server & group power monitoring
- Virtualization (vCenter)
  - Host standby (S5) & power on
  - VM suspend/resume
  - VM placement & migration
  - Host & VM load monitoring
- Application (Perf. Agent)
  - Application KPI monitoring

Source: [Cloud Power Management with Intel® Microarchitecture \(Nehalem\) Processor-based Platforms](#)  
 Intel Developer Forum, September 2009





# Trusted Compute Pools



The screenshot shows the HyTrust Hosts management interface. A callout box highlights the following information:

- vCenter
- 10.10.10.102
- 10.10.10.101

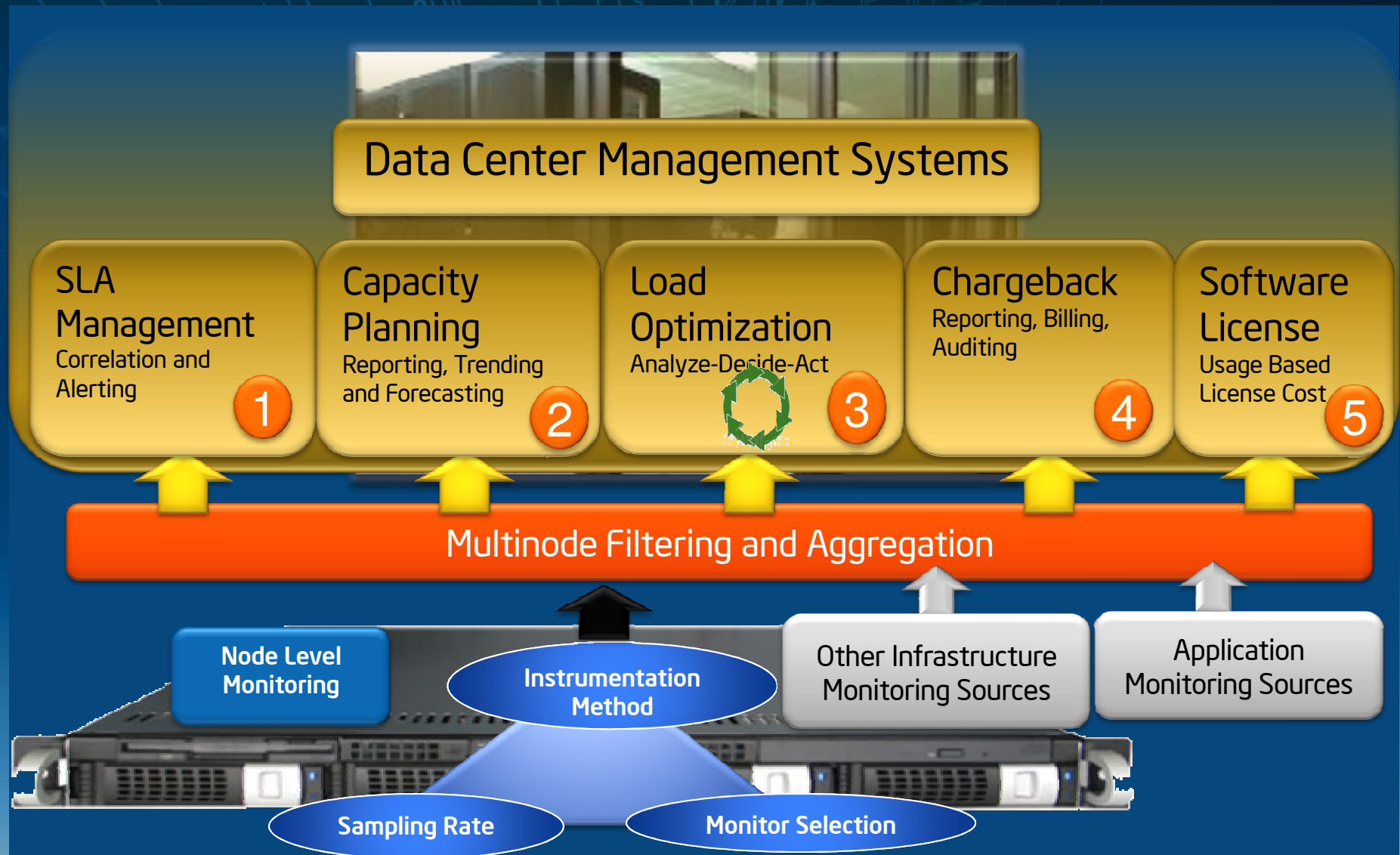
The main interface displays a table of hosts with the following data:

Selected	Hosts	Patch Level	Template	Status	Compliance
<input type="checkbox"/>	vCenter		N/A	N/A	N/A
<input type="checkbox"/>	10.10.10.102	VMware ESXi 4.0.0 build-164009	CIS-ESXi	-No Result-	0%
<input type="checkbox"/>	10.10.10.101	VMware ESXi 4.5.0 build-189688	CIS-ESXi	-No Result-	0%

**New Technology Can Improve the Security of Clouds**



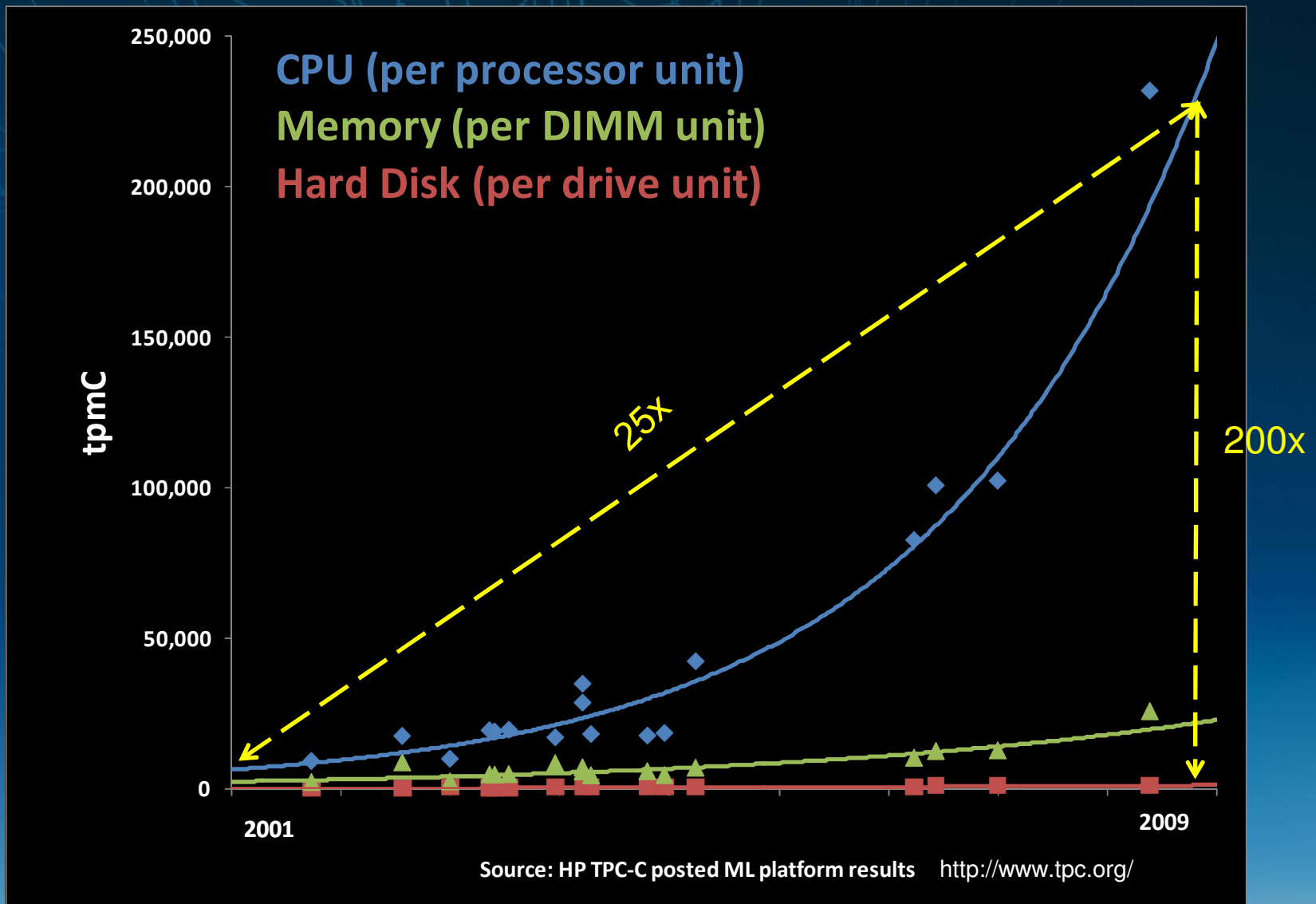
# And, How do you keep track of it all?



Many Needs for Better Monitoring in the Data Center



# The Data Center Bottleneck

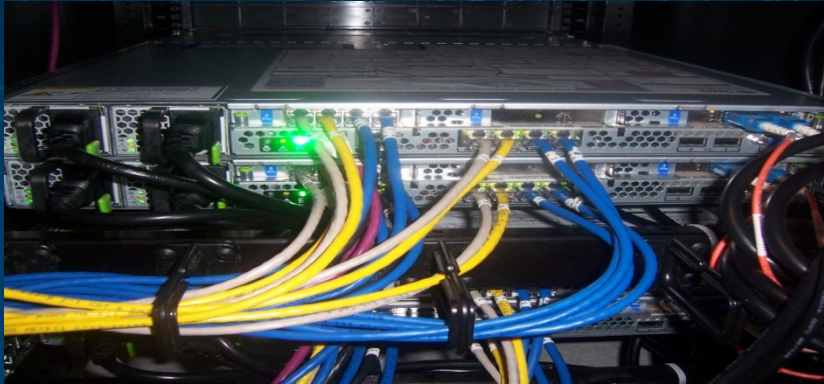


The performance of the basic DC building blocks is out of balance

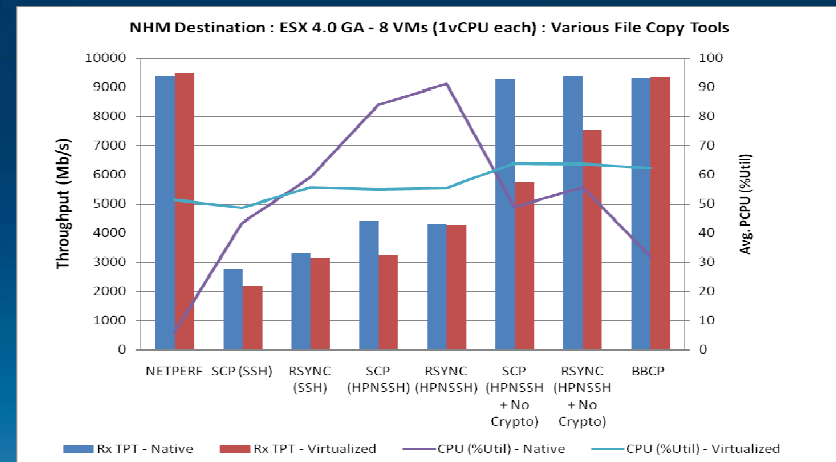
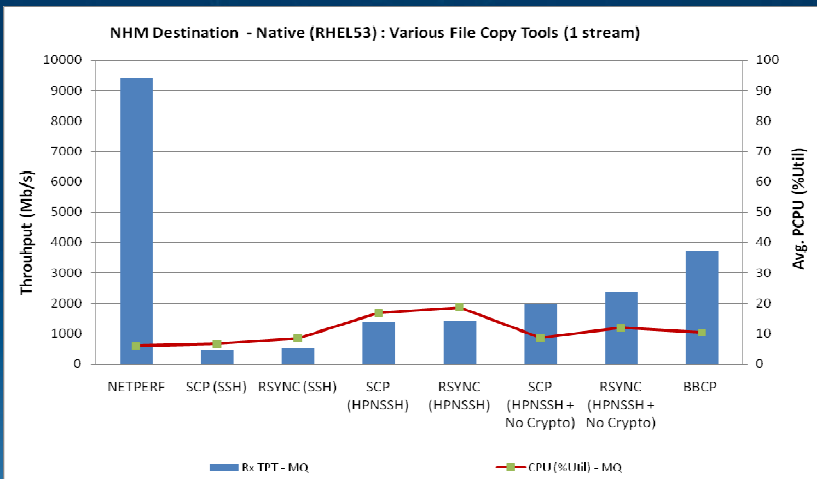
# Breaking the Network Bottleneck: Fed-Ex\* 10GbE Case Study

**Old datacenter:**  
10x 1GbE cables per server

**New datacenter:**  
2x 1GbE (mgmt.), 2x 10GbE (repl. 8x 1GbE)



10G uses 802.1q trunking and twinax cabling



Using 2 10GbE ports for iSCSI, and 2 for Ethernet, Fed-Ex reduced cost (~60%) and increased overall bandwidth

But, much complexity in the migration

Source: [Increased Virtual Machine Flexibility and Scalability with Intel® Virtualization Technology for Connectivity](#)  
Intel Developer Forum, September 2009

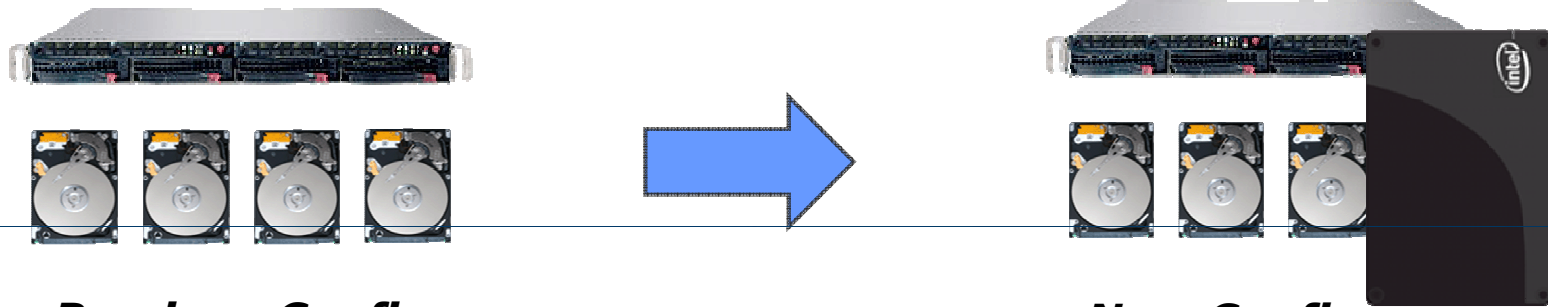
\* Other names and brands may be claimed as the property of others. Copyright © 2009, Intel Corporation.



# Breaking the Storage Bottleneck → Solid State Storage

## The Level 3\* Content Delivery Network

The Level 3 CDN required an alternative technology solution to provide a higher quality, better performing, lower cost environment for small-file content provider's libraries. The Intel SSD platform solved that requirement.



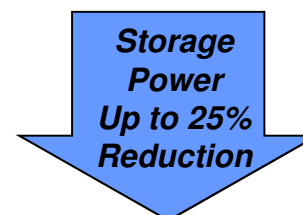
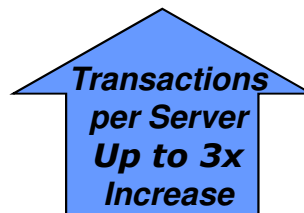
### **Previous Config:**

*Dual-Core Intel® Xeon® Processor  
Four SATA HDDs  
24 - servers per rack*

### **New Config:**

*Dual-Core Intel® Xeon® Processor  
Three SATA HDDs  
Intel® X25M SATA SSD  
24 - servers per rack*

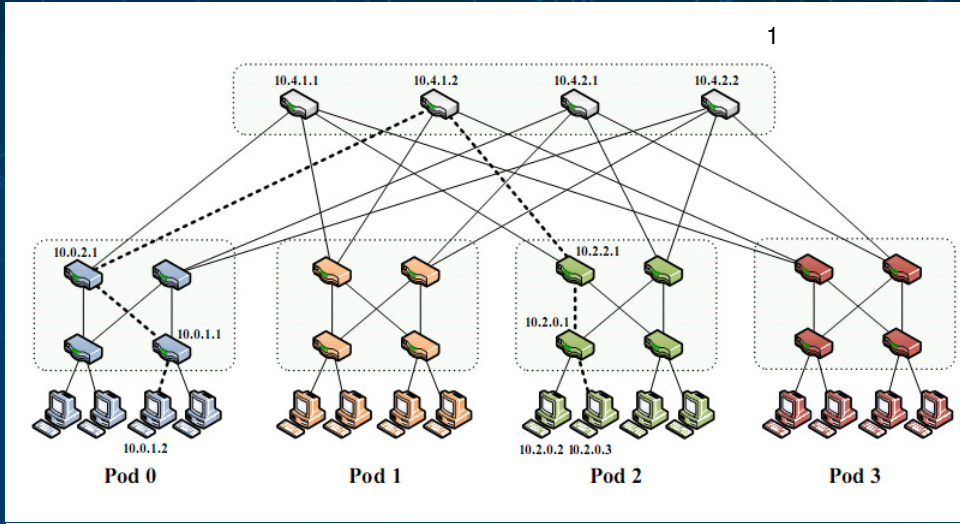
## The Bottom Line Results



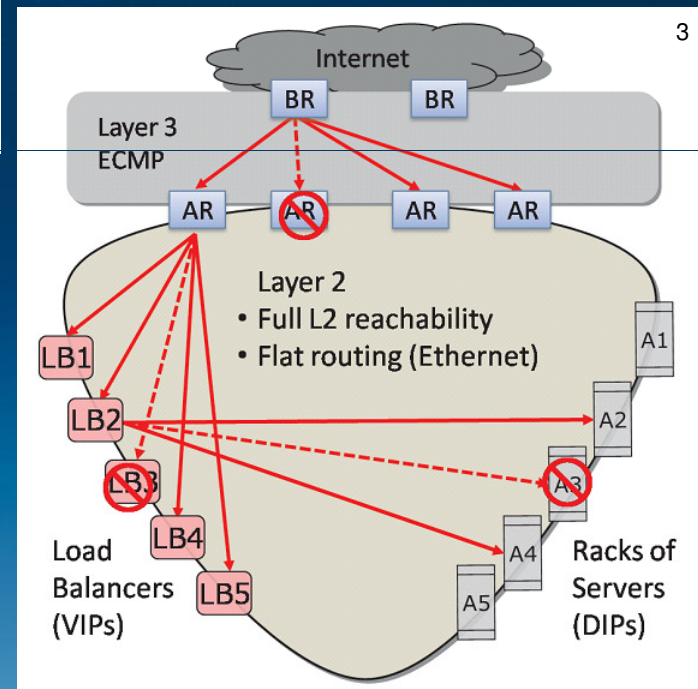
Source: Designing Solid-State Drives (SSDs) into Data Center Solutions, Intel Developer Forum, September 2009

# What about higher in the DC Network

2



- 100 racks @ 18 servers/rack can produce 18 Tbps of storage and network traffic
- DC Backbones have never been designed for this scale even with oversubscription.
- New Architectures Emerging



Source: Scalable, Commodity Data Center Network Architecture <http://ccr.sigcomm.org/online/?q=node/378>

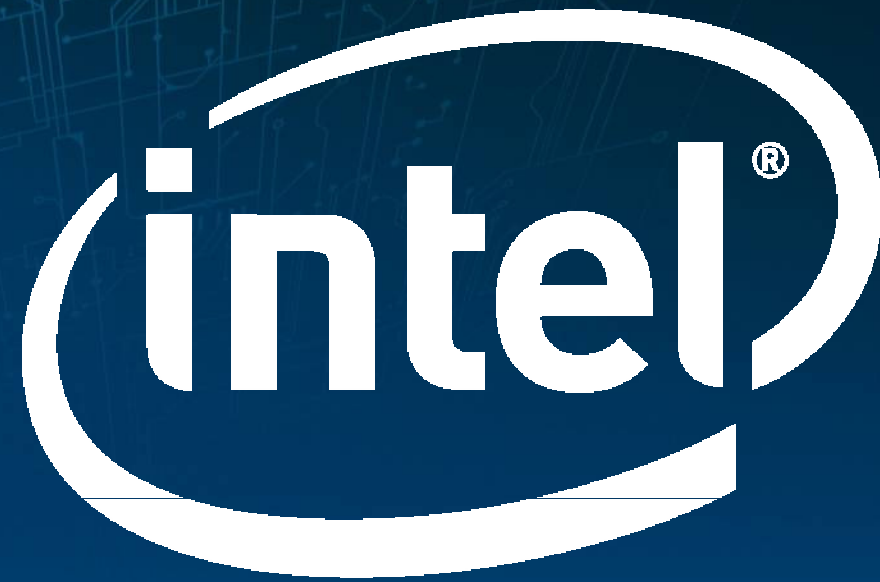
Source: Towards a Next Generation Data Center Architecture: Scalability and Commoditization PRESTO'08, August 22, 2008, Seattle, Washington, USA.



# Summary

- Cloud Computing  $\neq$  Commodity Computing
- New Technologies and Architectures Emerging for “Factory Class Computing”
- What Clouds do today is the tip of the iceberg.





**THANK YOU!**





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